



H.F.R.I.
Hellenic Foundation for
Research & Innovation

Description of the funded research project
1st Call for H.F.R.I. Research Projects to Support Faculty
Members & Researchers and Procure High-Value
Research Equipment

Title of the research project: Novel technologies of isolation and micro-nano encapsulation for personalized 3-D food printed nutritional products. Detection of metabolic products through breath analysis.

Principal Investigator: Professor Magdalini Krokida

Reader-friendly title: NutrID

Scientific Area: Agricultural Sciences – Food Science and Technology

Institution and Country: National Technical University of Athens/Greece

Host Institution: National Technical University of Athens

Collaborating Institution(s): Harokopio University & Liverpool University

Project webpage: www.nutridproject.gr

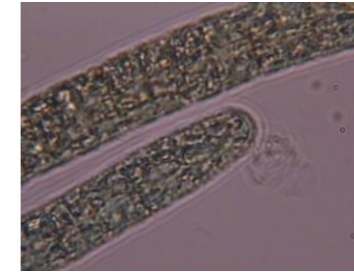


Image of raw Spirulina from an optical microscope



Breath sampling procedure of an athlete that has consumed Spirulina



Principal Investigator: Professor Magdalini Krokida

Budget: 170.000 €

Duration: 36 months

Research Project Synopsis

The main purpose of the NutrID proposal is the development innovative food products innovative food products aimed at specific population groups with the ultimate goal of personalized nutrition according to the needs and nutritional profile of the consumer. In the framework of this project one of the most demanding groups in terms of nutrition will be studied, athletes. Nutritional interventions will be performed in order to detect in athletes' organism the levels of the desirable substances consumed through food products. The products that will be developed will be enriched with proteins, omega-3 fatty acid and finally phenolic extracts that will contribute significantly to the well-being of the athletes and reduce exercise-induced muscle damage (EIMD), a pathophysiological phenomenon occurred after intense or accustomed exercise which impairs the recovery of athletes; EIMD is characterized by the acute activation of oxidative stress. Specifically, whey protein extracts from dairy industry, omega-3 fatty acid from microalgae and finally phenolic extracts from by-products of olive oil processing will be used. The extractions will be microwave and ultrasound assisted in order to obtain the maximum yield of the desired substances and be environmental friendly. The use of electrospinning / electrospraying technique for the successful encapsulation of the abovementioned extracts in appropriate matrices for the incorporation into the final product, since it is a technique that does not limit the use of any substance for encapsulation or matrix, and provides the ability of simultaneously encapsulation of many substances. 3-D food printing will be used to integrate encapsulated bioactive compounds so as athletes to receive the with desirable nutrients. In order to monitor the absorption of bioactive compounds by athletes' organism, a nutritional interventions will performed that will link the metabolism of target compounds with volatile organic compounds (VOCs) of athletes' exhaled air, using TDU-GC-MS technique.

Project originality

The innovation of the proposal is based not only on novel extraction and encapsulation methods but also on the type of extracts. Despite the proven pleiotropic beneficial actions of the supplement's constituents separately, their combination in one single supplement does not exist although there is the strong possibility of synergism of their actions. This synergy is expected to be stronger for the attenuation of exercise-induced muscle damage (EIMD), a pathophysiological phenomenon occurred after intense or accustomed exercise which impairs the recovery of athletes.

EIMD is characterized by the acute activation of oxidative stress and inflammation both of which are attenuated by the intake of the supplement's bioactive compounds. Under this perspective the controlled release of the bioactive compounds could allow us to achieve a regulated, mild inhibition of the oxidative stress and inflammatory mechanisms avoiding their complete inhibition.

In regard to the existing methodologies that are relevant to the monitoring of food products biotransformation through clinical studies, it seems that they are often considered time consuming and not readily repeatable, as they require human blood or urine analysis. Alternatively, exhaled air analysis could be used, mostly because of its noninvasive character. The determination of marker compounds (VOCs) in exhaled air by using state-of-the art analytical techniques will help us identify the differentiations in the exhaled air profiles of the athletes concerning oxidative stress when they follow a specific diet enriched with bioactive compounds.

Expected results & Research Project Impact

The implementation of NutrID will bring multiple benefits from a scientific, social and economic point of view. The academic and research community will gain significant scientific benefits by conducting innovative research with high practical and commercial interest. Furthermore, new researchers who will participate will be trained in the innovative processes and technologies developed within the project. As a result, the quality of the Greek scientific community will be enhanced.

Regarding the economic benefits, which result from the successful development and exploitation of high added value products enriched with polyunsaturated ω -3 fatty acids, whey protein and phenols from food industries, will initially open new markets (e.g the market of innovative products that meet personalized needs, market of supplements rich in antioxidants, etc.). In addition, the NutrID proposal will have a significant economic impact, as a wide range of raw materials that are still untapped resources will be exploited through new, easily applicable in industry and cost-effective processes. New job opportunities will be created for specialized technical staff. Significant economic benefits for the national economy will arise from the direct exploitation of the expertise that will be produced during the research program.

Concerning the social benefits, the proposed methods of extraction, encapsulation, product development, and bioactive compounds detection will reduce environmental footprint by minimizing the energy and water use, while suggesting full exploitation of the by-products of the cheese industry, which have a large market share in Greece, ensuring its sustainability. Finally, the use of the bioactive ingredients obtained in the project will potentially lead to the development and production of innovative food products, enriched with natural substances that will have significant social and health benefits.

The importance of this funding

HFRI funding contributes to the expansion of the scientific field of this study and to the development and optimization of innovative technologies. It also contributes to the recruitment of appropriate new research staff, the purchase of new equipment and the maintenance of instruments. In addition, the results will be published in reputable journals and conferences where future collaborations and promotion of the final product may occur.



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